Stability and Change
The Dark Factor of Personality Shapes Dark Traits
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Stability and change: The Dark Factor of Personality shapes dark traits

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Additional information and materials including data, scripts, and outputs of analyses are available in the Supplemental Material as well as at the Open Science Framework (OSF) via https://osf.io/msjvn/?view_only=6673c437c92a4df291b1daae2cb55ad

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Abstract

The Dark Factor of Personality (D) is conceptualized as the basic disposition out of which ‘dark’ traits arise as specific manifestations. We herein critically test this conceptualization across nine dark traits in a four-year longitudinal study with $N = 1,261$ ($n = 470$ at the second measurement occasion, employing full information maximum likelihood estimation) adults from the general population. Results strongly support the conceptualization of D. Specifically, D (1) showed a high rank-order stability (higher than any of the dark traits), substantiating that it represents a basic disposition; (2) longitudinally predicted individual differences in all dark traits; and (3) accounted for personality changes in dark traits. Additionally, we also investigated the pattern of mean-level change of D and the dark traits. In line with the maturity principle of personality development, D (and most dark traits) decreased with age.

Keywords: D factor; dark traits; personality; mean-level change; rank-order stability
As countless examples vividly demonstrate, some people show a consistent pattern of malevolent behavior. Subclinical tendencies for such behavior are summarized in traits grouped under the umbrella term dark traits (Paulhus, 2014). In recent years, there has not only been a clear upsurge of interest in dark traits (Muris, Merckelbach, Otgaar, Meijer, 2017), but also a notable increase in the number of dark traits suggested (e.g., Marcus & Zeigler-Hill, 2015; Paulhus & Jones, 2015). Given the large theoretical, operational, and empirical overlap between dark traits (e.g., Muris et al., 2017; Vize, Lynam, Collison, & Miller, 2018), researchers have repeatedly proposed that several of these traits actually share a common core (e.g., Diebels, Leary, & Chon, 2018; Jones & Figueredo, 2013).

Integrating and extending other accounts of such a common core, Moshagen, Hilbig, and Zettler (2018) presented a unifying conceptualization spanning all dark traits. Specifically, they argued that all dark traits are flavored manifestations of the general underlying tendency “to maximize one’s individual utility—disregarding, accepting, or malevolently provoking disutility for others—, accompanied by beliefs that serve as justifications” (p. 657). Since this tendency is conceptually and operationally defined as the common factor across all dark traits, it is termed the Dark Factor of Personality, or simply D.

Moshagen et al. (2018) conceptualized D as a basic disposition from which any single dark trait arises as a specific, flavored manifestation. Being ‘flavored’ refers to two features: First, dark traits may differ in terms of how strongly they represent one of the defining aspects of D. For instance, inflicting harm on others is particularly pronounced in a trait like Sadism. Second, dark traits may comprise particular aspects beyond D, e.g., planfulness as an aspect of Machiavellianism (Collison, Vize, Miller, & Lynam, 2018), which is (theoretically) beyond D. Consequently, any single dark trait is 'flavored' in that it represents a specific pronunciation of the defining aspects of D and that it may comprise unique aspects beyond D.

In line with this conceptualization of D vis-à-vis specific dark traits, Moshagen et al. (2018) explicitly conceptualized D as a fluid construct, similar to the g factor of intelligence.
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(e.g., Jensen, 1998). This conceptualization implies indifference of the indicators, that is, *any* item (indicator) representing a dark trait also indicates D to a certain extent. D can thus be measured via the commonalities of different dark trait items, relatively irrespective of which exact items are considered—as long as there is a sufficient number of items with a sufficient breadth in content (e.g., items assessing ‘egoistic’, ‘sadistic’ etc. aspects). At the same time, given that dark traits represent flavored manifestations of D, any one scale assessing a particular dark trait arguably cannot fully reflect the breadth of D, nor can an item set assessing D necessarily account for every aspect of any specific dark trait.

Supporting this conceptualization, several large-scale studies confirmed that a single factor (‘D’) captures the commonalities between different dark traits, including Amoralism, Egoism, Greed, Machiavellianism, Moral Disengagement, antagonistic Narcissism, Psychological Entitlement, Psychopathy, Sadism, Self-Centeredness, and Spitefulness (Moshagen et al., 2018; Moshagen, Zettler, & Hilbig, 2020). In these studies, D consistently accounted for most of the common variance of the items. In fact, D accounted for more than 50%—and typically much more up to 100%—of the common variance of items deemed to measure a specific dark trait.\(^1\) In line with this picture, specific dark traits only rarely improved the prediction of more than 20 relevant self-reported and behavioral criteria in the realm of malevolence (e.g., aggression, dishonesty, selfishness) over D (Moshagen et al., 2018, 2020).

Whereas the evidence provided so far supports the conceptualization of D in general, the crucial idea that dark traits arise as flavored manifestations from D—i.e., that D shapes

\(^1\) Notably, the D-saturation of the items from the administered agentic Narcissism as well as Self-Interest scales only ranged between 12-18% (Moshagen et al., 2018)—as discussed in more detail by Moshagen et al. (2018; see also Moshagen et al., 2020), however, these traits might rather not be considered as fully-fledged dark traits, if at all.
dark traits—has not been critically tested based on longitudinal data yet. Indeed, there is no
evidence on (1) the long-term stability of D, also in comparison to the long-term stability of
dark traits, to substantiate that D is an underlying basic disposition; (2) whether D
longitudinally predicts individual differences in specific dark traits; and (3) whether
longitudinal changes in dark traits follow the longitudinal change in D.

In line with common definitions of personality traits, D and its manifestations (all dark
traits) are assumed to represent “probabilistic descriptions of relatively stable patterns of
emotion, motivation, cognition, and behavior” (DeYoung, 2015, p. 35). Correspondingly, D
and dark traits need to show stability over time. For the first time, we herein investigate the
rank-order stability of D over time (namely, four years), expecting it to lie at least in the range
as typically observed for broad personality traits, that is, around $r = .60-.75$ (e.g., Roberts &
DelVecchio, 2000; Specht, Egloff, & Schmuckle, 2011; Hypothesis 1a). By implication, we
expect each of the dark traits considered to show rank-order stability, too (Hypothesis 1b),
although arguably a bit lower as compared to the rank-order stability of D (if the latter is the
more basic, underlying disposition).

Second, and arguably even more crucially, the conceptualization of D as the
underlying disposition and dark traits as flavored manifestations thereof implies that D shapes
dark traits such that D longitudinally predicts individual differences in dark traits. In other
words, an individual’s level in D must predict later levels in all dark traits. Thus, we link D to
several dark traits assessed four years later, hypothesizing that D predicts a substantial
proportion of the variance in all dark traits assessed (Hypothesis 2).

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2 Note that this as well as other common definitions of personality traits explicitly consider stable
cognitions (or, e.g., “thoughts” in Roberts, 2009, p. 140) as part of a personality trait, although this is made more
explicit in the definition of D (“accompanied by beliefs…”) as compared to many other specific personality trait
definitions.
Finally, and complementing the investigation whether D shapes dark traits, any personality change in D over time must account for corresponding changes in dark trait levels. In other words, individuals’ changes in the level of a dark trait must be explained by their changes in the level of D. Consequently, we link 4-year changes in D to 4-year changes in dark traits, hypothesizing that changes in dark traits will be predicted by changes in D (Hypothesis 3).³

Beyond the crucial tests whether D is a basic disposition shaping dark traits, corresponding data also allow to investigate whether mean-level change of D and/or dark traits occurs at all. Mean-level change, or normative change, occurs if a cohort displays different mean levels on a trait at two time points. Theoretically, mean-level change of D and dark traits in adulthood should follow the maturity principle of personality development (Roberts & Nickle, 2017), suggesting that personality traits change to become more “functional for mastering developmental tasks important in executing adult responsibilities” (Specht et al., 2014, p. 220). Maturity can be characterized by being reliable in one’s tasks and responsibilities, being less erratic and volatile overall, and ”must take into account the relationship between the individual and his or her society” (Hogan & Roberts, 2004, p. 214).

D and dark traits, in contrast, refer to the degree to which one prioritizes one’s interests at the costs of others. In line with the maturity principle as well as research findings on the mean-level change of specific dark traits (e.g., Carlson & Gjerde (2009, 2010; Grosz et al., 2019; Klimstra et al. (2020) or of relevant basic dimensions of personality including Agreeableness, Conscientiousness, and Honesty-Humility (e.g., Ashton & Lee, 2016; Milojev & Sibley, 2017; Roberts, Walton, & Viechtbauer, 2006; Specht et al., 2011)—the basic traits that D and

³ Plausibly, the degree to which D will predict variance in a dark trait as well as the degree to which change in a dark trait is attributable to change in D should generally mirror the degree to which the items reflecting this particular dark trait are saturated by D.
dark traits correlate with most strongly (negatively) overall (Moshagen et al., 2018; Muris et al., 2017)—in adulthood, we expect a mean-level decrease in D and the dark traits in adulthood (Hypothesis 4).

**Methods**

**Participants and Procedure**

Data were obtained through a German professionally managed online panel and refer to two measurement occasions (T1 in 2014, and T2 in 2018). Every measurement occasion started with participants providing informed consent and demographics. After completing the questionnaire measures, participants were thanked, debriefed, and redirected to the panel provider. Participants received a flat fee (determined by the panel provider) for every measurement occasion completed.

In 2014, 1,261 participants (52% male, aged between 18 and 65, \(M = 41.78, SD = 13.17\), years) completed the nine dark trait measures (see below) as reported in detail in Moshagen et al. (2018, Study 3, first measurement occasion).

From these, 1,220 participants could be re-invited in 2018 (41 participants left the panel in the meantime). Data matching was achieved via completely anonymous random codes and was verified using demographic data provided by the participants. Of the 509 individuals who responded in 2018 (response rate 41.72%), 2 revoked consent, 9 did not complete the study, 28 were excluded because of inconsistent demographics, and another 2 were excluded because of suspicious response behavior. Thus, the 2018 sample comprised usable responses of 470 individuals (52% male; mean age = 49.35, \(SD = 12.74\) years; overall retention rate = 37%). The average time lag between the measurements was 46.02 (\(SD = 0.14\)) months. Responders and non-responders did not differ concerning gender, \(\chi^2(1) = 0.03, p = .87\), education, \(\chi^2(4) = 2.87, p = .58\), or their level in D in 2014, \(t(1259) = 1.07, p = .28\). However, responders tended to be older than non-responders, \(d = 0.41, t(1259) = 7.10, p < .01\).
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Measures

In 2018, we assessed the same nine dark traits—and, in turn, D—via the same self-report questionnaires as in 2014. A five-point Likert response scale ranging from 1 = strongly disagree to 5 = strongly agree was used for all questionnaires. Except for gender and age (to check for correspondence between the measurement occasions), no other variables were assessed in 2018. Specifically, we administered the following questionnaires (presented in random order):

**Egoism** was assessed via the 12-item Egoism Scale introduced by Weigel, Hessing, and Elffers (1999).

**Machiavellianism** was assessed via the Short Dark Triad (Jones & Paulhus, 2014). Note that the respective subscale of the German version (Maaß & Ziegler, 2017) differs slightly from the respective English original subscale by consisting of 10 (compared to 9) items.

**Moral Disengagement** was assessed via the 8-item Propensity to Morally Disengage Scale, introduced by Moore, Detert, Treviño, Baker, and Mayer (2012).

**Narcissism** was assessed via the 9-item subscale of the Short Dark Triad (Jones & Paulhus, 2014).

**Psychological Entitlement** was assessed via the 9-item Psychological Entitlement Scale introduced by Campbell, Bonacci, Shelton, Exline, and Bushman (2004).

**Psychopathy** was assessed via the 9-item subscale of the Short Dark Triad (Jones & Paulhus, 2014).

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4 For consistency across T1 and T2, we also re-assessed agentic Narcissism and Self-Interest and included them in the analyses reported herein, although they do not reflect fully-fledged dark traits, if at all (see Moshagen et al., 2018, 2020), and largely comprise variance beyond D. For better readability, we just include them under the ‘dark trait’ umbrella term herein.
Sadism was assessed via the 10-item Short Sadistic Impulse Scale (O’Meara, Davies, & Hammond, 2011).

Self-interest was assessed via the 9-item subscale of the Self- and Other-Interest Inventory (Gerbasi & Prentice, 2013).

Spitefulness was assessed via the 17-item Spitefulness Scale, introduced by Marcus, Zeigler-Hill, Mercer, and Norris (2014).

Statistical Analyses

We used longitudinal structural equation modeling to investigate rank-order stability and mean-level change over time (e.g., Newsom, 2015). Different types of models were estimated to determine stability of D and to determine stability of the dark traits. D was estimated using bifactor modeling (e.g., Reise, 2012). Note that both bifactor and higher-order models are members of the class of hierarchical factor models and are equivalent when the proportionality assumption is met. We relied on the bifactor approach because it requires fewer assumptions, has certain statistical advantages, and is more closely aligned with the theoretical conceptualization of D (for a further discussion, see Moshagen et al., 2018).

Briefly, each observed item of any dark trait measure is modeled to load both on D (thereby capturing the commonalities among all items at a particular measurement occasion) and on a specific dark trait (capturing the remaining covariance among the items belonging to the respective measure that is not due to D). In total, the model for D thus comprised 2 general factors (representing D in 2014 and 2018, respectively) and 18 specific factors (representing each of the nine dark traits, residualized for D, in 2014 and 2018, respectively).

All correlations between the specific factors as well as between D and the specific factors at a particular measurement occasion were fixed to zero. In contrast, all factors were allowed to covary over time, i.e., D and the specific factors measured in 2014 were allowed to correlate with D and the specific factors measured in 2018. All item uniquenesses within the same measurement occasion were orthogonal, whereas the uniquenesses of the same item
were allowed to covary over time to capture stable item-specific variance. To gauge the proportion of variance explained by D versus a specific factor, we considered the ECVs (calculated separately for each measure as well as for each measurement occasion). The ECV is defined as the ratio of variance explained in the items by D to the variance explained by D and the respective specific factor (Reise, 2012).

To determine rank-order stability and mean-level change for the dark traits, we estimated standard congeneric confirmatory factor models. The models comprised one factor for each trait and measurement occasion (18 latent factors in total). All factors were allowed to covary. The item uniquenesses were constrained to orthogonality within a particular measurement occasion, but we allowed the uniquenesses of the same item to correlate over time.

In the models investigating whether D (measured 2014) predicts a dark trait (measured 2018) and whether changes in D (from 2014 to 2018) predict changes in a dark trait (from 2014 to 2018), we omitted the items of the to-be-predicted dark trait from the measurement model of D to avoid predictor-criterion contamination. For instance, when testing whether D (2014) predicts Egoism (2018), D (2014) was indicated by all items measured in 2014 except those from the Egoism scale.

We aimed to establish strict factorial invariance to allow meaningful interpretations across time. Tests of measurement invariance proceeded by first estimating an unconstrained model as a baseline (configural invariance), then constraining all loadings to be equal across time (metric invariance), then restricting all item intercepts to be equal over time (scalar invariance), and finally constraining the item uniquenesses to be equal over time (strict invariance).

Note that the specific factors arising in the bifactor model represent the dark traits residualized with respect to D and thus non-trivially differ in the meaning from the non-residualized dark traits (see Moshagen et al., 2018). We therefore do not consider the specific factors in further detail.
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invariance). Given strict invariance, we also investigated invariance of the latent structure by constraining the factor variances and—in the models for the dark traits—the factor covariances over time. To identify the latent means in the scalar invariance models (and onwards), a single occasion identification approach was employed, i.e., the latent mean of all factors in 2014 were fixed to zero whereas the latent means of the factors in 2018 were freely estimated.

Latent difference score models (McArdle & Hamagami, 2004) were employed to investigate whether changes in D predict changes in dark traits from 2014 to 2018. Second-order latent difference score models define a latent variable representing the difference between measurement occasions on a latent factor. In the present study, the latent difference score models were based on the strict invariance models (using a single-occasion identification for the latent means) and assumed correlated latent differences for all dark traits investigated.

All models were estimated using Mplus (version 7.11; Muthén & Muthén, 2015) based on the raw scores. We assumed that data were missing at random and thus addressed incomplete data at T2 by employing full information maximum likelihood estimation (in turn, although \( n = 470 \) participated at T2, the analyses are based on \( N = 1,261 \)). As a robustness check, we repeated all analyses using listwise deletion (which makes the stronger assumption of ‘missing completely at random’), yielding highly similar findings. In addition, we ran a recovery simulation to verify that the sample is sufficiently large to support the models under scrutiny (see additional material in the OSF).

Assessment of model fit proceeded through the log-likelihood ratio test statistic. Non-normality in the data was addressed by Huber-White sandwich estimated standard errors and corrected test-statistics (Yuan & Bentler, 2000), relying on scaled chi-square differences between nested models (Satorra & Bentler, 2010). Given the extremely high power of the chi-square test (with \( N = 1,261 \), the power to detect misspecifications of the estimated models
corresponding to $RMSEA = .01$ with $\alpha = .05$ is $1 - \beta > 99%$; Moshagen & Erdfelder, 2016), we additionally evaluated descriptive indices of fit. In line with recent recommendations (Moshagen & Auerswald, 2018), we considered the point estimates of the $SRMR$ and the $RMSEA$ (along with 90% confidence intervals) based on the convention that values for the $SRMR$ around .08 and for the $RMSEA$ around .06 indicate well-fitting models (Browne & Cudeck, 1992). In the evaluation of competing models (i.e., the test of invariance), we considered $\Delta CFI < -.01$ and $\Delta Mc < -.02$ as being indicative of a meaningful difference (Cheung & Rensvold, 2002; Fan & Sivo, 2009).

**Results**

Table 1 shows the observed means and standard deviations of D and the dark trait measures. As is typical in dark trait research, there was an average trend to self-report dark trait levels below the neutral response option.

Table 1

*Observed Means and Standard Deviations of D and the Dark Trait Measures*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD) 2014</th>
<th>Mean (SD) 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>2.35 (0.38)</td>
<td>2.22 (0.40)</td>
</tr>
<tr>
<td>Egoism</td>
<td>2.66 (0.58)</td>
<td>2.53 (0.61)</td>
</tr>
<tr>
<td>Machiavellianism</td>
<td>2.89 (0.59)</td>
<td>2.78 (0.62)</td>
</tr>
<tr>
<td>Moral Disengagement</td>
<td>2.04 (0.58)</td>
<td>1.82 (0.55)</td>
</tr>
<tr>
<td>Narcissism</td>
<td>2.74 (0.54)</td>
<td>2.58 (0.62)</td>
</tr>
<tr>
<td>Psychological Entitlement</td>
<td>2.66 (0.63)</td>
<td>2.62 (0.72)</td>
</tr>
<tr>
<td>Psychopathy</td>
<td>1.89 (0.55)</td>
<td>1.71 (0.54)</td>
</tr>
<tr>
<td>Sadism</td>
<td>1.49 (0.48)</td>
<td>1.41 (0.49)</td>
</tr>
<tr>
<td>Self-Interest</td>
<td>3.36 (.59)</td>
<td>3.21 (.66)</td>
</tr>
<tr>
<td>Spitefulness</td>
<td>1.82 (.49)</td>
<td>1.66 (.46)</td>
</tr>
</tbody>
</table>

Table 2 shows the results concerning measurement invariance of both the dark traits and D over time. Strict factorial invariance as well as invariance of factor variances across time was supported with regard to both the dark traits and the bifactor model for D. Consequently, all findings reported in the following are based on the models assuming strict
factorial invariance and invariant factor variances over time, given that these provide the most parsimonious description of the data. Table 3 shows the internal consistencies and correlations between the dark traits across both measurement occasions (based on the strict factorial invariance model).
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Table 2

Tests of Measurement Invariance over Time for the Dark Traits as well as D

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$ (df)</th>
<th>$p$</th>
<th>RMSEA</th>
<th>SRMR</th>
<th>Model comparison</th>
<th>$\Delta \chi^2$ ($\Delta$df)</th>
<th>$p$</th>
<th>$\Delta$CFI</th>
<th>$\Delta$Mc</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dark Traits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configural</td>
<td>32,943 (16,773)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.063</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>33,002 (16,857)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.063</td>
<td>2 vs. 1</td>
<td>92 (84)</td>
<td>.25</td>
<td>.001</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Scalar</td>
<td>33,310 (16,941)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.063</td>
<td>3 vs. 2</td>
<td>182 (84)</td>
<td>&lt; .01</td>
<td>-.004</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Strict</td>
<td>33,606 (17,034)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.065</td>
<td>4 vs. 3</td>
<td>168 (93)</td>
<td>&lt; .01</td>
<td>-.003</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Variances</td>
<td>33,663 (17,043)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.066</td>
<td>5 vs. 4</td>
<td>46 (9)</td>
<td>&lt; .01</td>
<td>.000</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Covariances</td>
<td>33,725 (17,079)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.066</td>
<td>6 vs. 5</td>
<td>70 (36)</td>
<td>&lt; .01</td>
<td>-.001</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Configural</td>
<td>32,514 (16,640)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.066</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>32,638 (16,816)</td>
<td>&lt; .01</td>
<td>.027</td>
<td>.067</td>
<td>2 vs. 1</td>
<td>114 (176)</td>
<td>&gt; .99</td>
<td>.001</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Scalar</td>
<td>32,915 (16,899)</td>
<td>&lt; .01</td>
<td>.027</td>
<td>.068</td>
<td>3 vs. 2</td>
<td>175 (83)</td>
<td>&lt; .01</td>
<td>-.003</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Strict</td>
<td>33,191 (16,992)</td>
<td>&lt; .01</td>
<td>.027</td>
<td>.069</td>
<td>4 vs. 3</td>
<td>167 (93)</td>
<td>&lt; .01</td>
<td>-.003</td>
<td>&gt; -.0001</td>
</tr>
<tr>
<td>Variances</td>
<td>33,283 (17,002)</td>
<td>&lt; .01</td>
<td>.028</td>
<td>.070</td>
<td>5 vs. 4</td>
<td>67 (10)</td>
<td>&lt; .01</td>
<td>-.001</td>
<td>&gt; -.0001</td>
</tr>
</tbody>
</table>

Note. All $\Delta$ indices were calculated by subtracting the value of the less constrained from the more constrained model. $\Delta \chi^2$ refers to the scaled difference between the $\chi^2$ statistics.
Table 3

Internal Consistencies and Correlations between Dark Traits across both Measurement Occasions

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
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<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
<th>11.</th>
<th>12.</th>
<th>13.</th>
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<tbody>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td>.74</td>
<td>.83</td>
<td></td>
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<td>.74</td>
<td></td>
<td>.83</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. Egoism</td>
<td>.74</td>
<td>.71</td>
<td>.23</td>
<td>.64</td>
<td>.50</td>
<td>.45</td>
<td>.50</td>
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<tr>
<td></td>
<td>(.83)</td>
<td>(.78)</td>
<td>(.73)</td>
<td>(.86)</td>
<td>(.72)</td>
<td>(.72)</td>
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</table>

**Note.** Dis. = Disengagement. Psych. = Psychological. Cronbach’s alpha estimate of internal consistency on the diagonal. Correlations are based on the strict factorial invariance model. Except for the correlation between Self-Interest 2014 and Sadism 2018, all correlations differ significantly from zero at \( p < .05 \). When using Bonferroni-Holm adjusted \( p \)-values, the following three correlations are not significant: Narcissism (2014)-Egoism (2018), \( p = .07 \); Sadism (2014)-Self-Interest (2018), \( p = .156 \); Spitefulness (2014)-Self-Interest (2018), \( p = .07 \).

Table 4 shows the explained common variances (ECVs) of the dark trait indicators at both 2014 (already reported in Moshagen et al., 2018) and 2018, the rank-order stability for D and dark traits, as well as the prediction of the dark traits (at 2018) by D (always modeled without the to-be-predicted dark trait). As can be seen, the ECVs in 2018 were highly similar to those in 2014: D measured in 2018 was strongly reflected in items measuring Psychopathy, Spitefulness, Machiavellianism, and Moral Disengagement, was responsible for
approximately half of the variance explained in the items designed to measure Egoism and Sadism, followed by Psychological Entitlement, but was only marginally reflected in the items of (agentic) Narcissism and Self-Interest.

Table 4

*Common Variance of the Dark Trait Indicators Explained by D, Rank-Order Stability for D and Dark Traits, as well as Prediction of Dark Traits 2018 by D 2014*

<table>
<thead>
<tr>
<th>Construct</th>
<th>ECV 2014</th>
<th>ECV 2018</th>
<th>Rank-order Stability</th>
<th>Prediction of Dark Traits 2018 $\beta_{D2014(\text{DT}2014)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>Egoism</td>
<td>.57</td>
<td>.56</td>
<td>.68</td>
<td>.57</td>
</tr>
<tr>
<td>Machiavellianism</td>
<td>.60</td>
<td>.61</td>
<td>.70</td>
<td>.67</td>
</tr>
<tr>
<td>Moral Disengagement</td>
<td>.61</td>
<td>.60</td>
<td>.67</td>
<td>.69</td>
</tr>
<tr>
<td>Narcissism</td>
<td>.18</td>
<td>.19</td>
<td>.77</td>
<td>.35</td>
</tr>
<tr>
<td>Psychological Entitlement</td>
<td>.38</td>
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<td>.70</td>
<td>.51</td>
</tr>
<tr>
<td>Psychopathy</td>
<td>.75</td>
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<td>.74</td>
<td>.75</td>
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<tr>
<td>Sadism</td>
<td>.43</td>
<td>.46</td>
<td>.61</td>
<td>.51</td>
</tr>
<tr>
<td>Self-Interest</td>
<td>.18</td>
<td>.17</td>
<td>.62</td>
<td>.27</td>
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<tr>
<td>Spitefulness</td>
<td>.62</td>
<td>.62</td>
<td>.61</td>
<td>.65</td>
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</tbody>
</table>

*Note. ECV = common variance explained by D. All rank-order stabilities differ significantly from zero at $p < .01$. Estimates are based on the strict factorial invariance model with invariant factor variances across time. $\beta_{D2014(\text{DT}2014)}$ refers to the standardized latent regression coefficient for D in 2014 predicting the respective dark trait in 2018, and was obtained in a model where D was defined by omitting the indicators (in 2014) of the to-be-predicted dark trait. All coefficients differ significantly from zero at $p < .01$.*

**Rank-Order Stability**

The rank-order stability of D was $r = .81$, supporting Hypothesis 1a. Notably, the rank-order stability of D was higher than the rank-order stability of any of the dark traits, which were also substantial, ranging from $r = .61$ for Sadism and Spitefulness to $r = .77$ for Narcissism, supporting Hypothesis 1b.

**Predicting Dark Traits in 2018 by D in 2014**
Hypothesis 2 referred to the prediction of each of the dark traits in 2018 by D measured four years earlier. To this end, we regressed the dark traits in 2018 on D measured in 2014 while specifying a standard confirmatory factor structure for the nine dark traits in 2018 and a bifactor structure for D in 2014 omitting the items of the to-be-predicted dark trait in modeling D. Note that the standardized regression slope is the same as the bivariate correlation in these analyses.

D in 2014 significantly predicted all dark traits in 2018, with $\beta$s ranging from .27 (Self-Interest) to .75 (Psychopathy). For all dark traits except Self-Interest and (agentic) Narcissism—which are plausible exceptions given their limited D-saturation and, relatedly, that the particular scales used do not represent fully-fledged dark traits (Moshagen et al., 2018, 2020)—, the $\beta$s were $\geq .51$, indicating a substantial prediction of a dark trait by D assessed four years earlier. Indeed, (descriptively) comparing these estimates with the rank-order stabilities of the dark traits, D predicted several dark traits to a similar degree as the respective trait itself. In the Supplemental Material, we further present the median correlations for each dark trait with all other dark traits in 2018 (both residualized and unresidualized for D in 2014), as well as median residualized correlations between the dark traits in 2018 when controlling for the dark traits in 2014 (including all autoregressive and cross-lagged effects). Results from these analyses also indicate that D accounted for a substantially larger proportion of the covariances between the dark traits at 2018, thereby also suggesting that D can be seen as an underlying source across all dark traits.

To investigate the fluid nature of D, we resorted to a resampling approach where D in 2014 was indicated by a random subset of 30 items (always excluding the items of the to-be-predicted dark trait) and then used to predict a particular dark trait in 2018. We repeated the sampling and estimation process 1,000 times for each dark trait. The distributions of the thereby obtained regression coefficients are summarized in Figure 1, showing that D in 2014 as defined by a random subset of the items predicted the dark traits in 2018 to a similar extent...
as before, thus supporting the fluid conceptualization of D. Overall, our results support Hypothesis 2 that D substantially predicts all dark traits longitudinally.

Figure 1
Psych. = Psychological. Distributions of correlations between D in 2014 and dark traits in 2018. The dashed line indicates the median. The measurement model for D was based on a random subset of 30 items (always excluding the items of the to-be-predicted dark traits). Resampling was performed 1,000 times each.

Predicting Changes in Dark Traits by Change of D

To test whether changes in dark traits are predicted by the change in D (Hypothesis 3), we ran a series of latent-change score models. We obtained the latent difference for the to-be-predicted dark trait using the respective indicator variables in 2014 and 2018, and the latent difference for D by a bifactor structure using all available indicators in 2014 and 2018, except for the 2014 indicators of the to-be-predicted dark trait. Changes in the dark traits could virtually always be traced back to a change in D (Table 5) with the only exception of Self-
Interest ($\beta = .06$). For the remaining dark traits, the change in D explained the change in each dark trait to a substantial degree ($0.25 \leq \beta \leq 0.76$), with $\beta$s $\geq .50$ in six cases. Thus, the results support Hypothesis 3 that changes in a dark trait can be explained by a change in D. Taken together, the results concerning Hypothesis 1a, 2, and 3 support that D is a basic disposition that shapes dark traits.

**Patterns of Mean-Level Change**

Finally, we inspected the mean-level change of D and dark traits in more detail, expecting a mean-level change in line with the maturity principle of personality development. As shown in Table 5, the standardized latent mean score on D decreased by about a third of a standard deviation ($\Delta \alpha = -0.31$) over four years. Similarly, the standardized latent mean score on each of the dark traits tended to decrease over time to a small to moderate extent ($-0.16 \geq \Delta \alpha \geq -0.39$), except for Psychological Entitlement ($\Delta \alpha = -0.05$) and Sadism ($\Delta \alpha = -0.09$), for which no significant mean-level change occurred. Overall, this supports Hypothesis 4, i.e., the levels in D and most dark traits tend to decrease with progressing age. In the Supplemental Material, we also report on results whether gender or age moderate the mean-level change of D or dark traits.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Latent Mean Difference$^{1}$</th>
<th>Predictor$^{2}$: Latent Mean Difference of D</th>
<th>$\beta$</th>
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<tr>
<td>D</td>
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<td></td>
</tr>
<tr>
<td>Egoism</td>
<td>-0.24*</td>
<td>0.52*</td>
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<tr>
<td>Machiavellianism</td>
<td>-0.16*</td>
<td>0.73*</td>
<td></td>
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<tr>
<td>Moral Disengagement</td>
<td>-0.39*</td>
<td>0.57*</td>
<td></td>
</tr>
<tr>
<td>Narcissism</td>
<td>-0.20*</td>
<td>0.25*</td>
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<tr>
<td>Psychological Entitlement</td>
<td>-0.05</td>
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<tr>
<td>Psychopathy</td>
<td>-0.27*</td>
<td>0.76*</td>
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<tr>
<td>Sadism</td>
<td>-0.09</td>
<td>0.38*</td>
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<tr>
<td>Self-Interest</td>
<td>-0.19*</td>
<td>0.06</td>
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<tr>
<td>Spitefulness</td>
<td>-0.34*</td>
<td>0.64*</td>
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Note. ¹ = Standardized latent mean difference with 2014 as reference. Estimates are based on the strict factorial invariance model with invariant factor variances across time. ² = Standardized latent regression coefficients predicting latent change score from 2014 to 2018. * p < .01

Discussion

The common core of socially aversive personality traits has been specified in the framework of the Dark Factor of Personality (D; Moshagen et al., 2018, 2020). D is theorized to be the basic disposition shaping dark traits; that is, the basic disposition from which all dark traits arise as more specific, flavored manifestations. We herein critically tested this conceptualization.

First, we showed that the rank-order stabilities of D and all dark traits over a 4-year period were high, thus supporting the trait conceptualization of D and dark traits. Indeed, the rank-order stabilities of the dark traits were similar to rank-order stabilities of the Big Five traits over a 4-year time span in a large sample comparable to ours (.64 ≤ r ≤ .74; Specht et al., 2011). Notably, the rank-order stability of D was actually higher than the stability of any of the Big Five (based on Specht et al., 2011) or dark traits (herein).

Whereas the present study thereby substantiates D as a stable disposition, we can only speculate about the factors that contribute to the development of D. Arguably, the development of D may be driven by mechanisms similar to those relevant in the development of other stable (dark) personality dispositions; that is, biological and environmental factors, and their interactions (e.g., Fisher & Brown, 2018; Vernon, Villani, Vickers, & Harris, 2008). Indeed, a first respective study on the common core of the Dark Triad found support for both genetic and environmental effects, but with quite different results depending on whether or not controlling for age and sex (Schermer & Jones, 2020). Somewhat relatedly, future
research might also aim to look at other characteristics potentially even underlying D, such as basic needs (see, e.g., Dweck, 2017).

Second, we showed that D (measured without the items of the to-be-predicted dark trait) longitudinally predicted a substantial proportion of the variance in all of the dark traits considered, often to a similar degree as compared to the rank-order stability of a dark trait itself. Notably, results were virtually identical when only a random subset of items was used to measure D, thereby supporting the notion of D as a fluid construct. Third, we found that changes in dark traits were predicted by changes in D. Overall, the results thus confirm—although based on Granger causality only—that D can be best understood as a basic disposition shaping dark traits as flavored manifestations thereof.

In tandem, the results on the prediction of dark traits by D and on the prediction of changes in dark traits by the change in D substantiate the idea that dark traits are flavored manifestations of D. However, it is an open question why D manifests itself in a particular flavored manifestation in some individuals, but in another manifestation in others. One explanation could be the interplay with other individual differences (which are not directly related to malevolent behavior) or with situation factors (e.g., upbringing, societal norms, life situations). In this regard, past research has also investigated potential reciprocal effects between dark traits (Sijtsema, Garofalo, Jansen, & Klimstra, 2019). Importantly, the idea of reciprocal effects is also represented in the factor approach of D as the common core, and, more generally, a network and a factor approach are difficult to distinguish (for a detailed description on this issue, see Bringmann & Eronen, 2018). Overall, future research might investigate more deeply the relations (also over time) across D, specific dark traits and/or different types (or clusters) of dark trait attributes, and other variables.

A potential limitation of the current investigation is the comparatively small sample size (in terms of actual responses) at T2. We tackled this by employing full information maximum likelihood estimation, given that it seemed appropriate to assume data were
missing at random, as well as by conducting a recovery simulation suggesting that the sample size was sufficient to obtain stable and unbiased parameter estimates. In addition, relying on listwise deletion yielded identical conclusions.

Overall, in a 4-year longitudinal study, we provided a critical test of the conceptualization of D as the basic disposition from which all dark traits arise as specific, flavored—in terms of both emphasizing specific aspects of D and potentially comprising aspects beyond D—manifestations. Specifically, we provided evidence for the claim that D is a basic disposition underlying dark traits: D displays a high rank-order stability, longitudinally predicts individual differences in specific dark traits, and change in D is associated with corresponding changes in dark traits. Beyond these crucial tests of the conceptualization of D, results also confirmed that D (and virtually all dark traits) decrease with age, in line with the maturity principle of personality development (Roberts & Nickel, 2017). Reviewing present and past (Moshagen et al., 2018, 2020) evidence, there is thus substantial support for the idea that D is the basic disposition capturing the core personality characteristics linked to malevolent behavior.
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THE DARK FACTOR OF PERSONALITY SHAPES DARK TRAITS


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*Structural Equation Modeling, 23,* 54–60. 

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*Psychological Assessment, 32,* 182–196. [https://doi.org/10.1037/pas0000778](https://doi.org/10.1037/pas0000778)


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Supplemental Material concerning the manuscript

“The Dark Factor of Personality Shapes Dark Traits”

Dark Trait Factor Correlations in 2018

We investigated whether and, if so, how the dark trait factor correlations in 2018 change depending on controlling or not controlling for D (measured in 2014). Specifically, Table S1 shows the median correlations between the dark traits in 2018 when not controlling for D (unresidualized) vs. controlling for D (residualized) in 2014. Across all dark traits, controlling for D reduces the median correlations by 31-64%.

When interpreting these numbers, it is important to note that D measured in 2014 cannot be expected to account completely for the covariances between the dark traits in 2018, simply because of its own imperfect stability (rank-order stability of .81). To illustrate this, consider the case in which a correlation of .60 between two variables (X, Y) at T2 is completely due to a third variable (Z; i.e., the correlation between X and Y at T2 residualized for Z at T1 is 0). If this third variable only correlates to .80 between T1 and T2, X and Y still correlate after controlling for Z at T1 to .25, thus, the maximum possible reduction is 68% (so the actually found reductions seem quite substantial in the light of the rank-order stability of D).

Table S1 further shows the median residualized correlations between the dark traits in 2018 when controlling for the dark traits in 2014 (including all autoregressive and cross-lagged effects). Here, the reduction lies between 12-40% and is thus substantially lower as compared to the results obtained when controlling for D measured in 2014.

Moderation of Mean-Level Change

We investigated from an exploratory point of view whether demographic characteristics (gender and age) moderate the mean-level change of D and dark traits. Gender is considered as a potential moderator because previous research has indicated different patterns of mean-level changes for men and women for some personality traits (e.g., Borghuis
et al., 2017; Branje, Van Lieshout, & Gerris, 2007; Vecchione, Alessandri, Barbaranelli, & Caprara, 2012). Age is considered as a potential moderator because some findings on personality development have suggested age to moderate mean-level changes either in a linear (e.g., Chopik & Kitayama, 2017) or curvilinear (Specht, Egloff, & Schmukle, 2011) manner. Consequently, we exploratively tested for linear or curvilinear effects of age on mean-level changes in D and dark traits.

Specifically, we entered gender (coded as 0 = female, 1 = male) and age at 2014 (mean-centered) as moderator variables predicting the latent mean differences in the latent difference score models as described in the main paper. Results are shown in Table S2. As can be seen therein, gender significantly predicted mean-level change only on (agentic) Narcissism with men exhibiting more change compared to women, i.e., the scores on (agentic) Narcissism exhibited a steeper decrease for men than for women. However, this effect was rather small ($\beta = 0.12$).

Age at 2014 did not have a linear effect on the mean-level change of any of the dark traits. However, a descriptive negative quadratic effect of age was evident on D and most dark traits, with the exceptions of (agentic) Narcissism and Self-Interest. This effect reached statistical significance for D ($\beta = -0.15$), Machiavellianism ($\beta = -0.19$), and Spitefulness ($\beta = -0.11$). To facilitate the interpretation of this quadratic effect, Figure S1 shows the predicted standardized latent mean change in D from 2014 to 2018 as a function of age at 2014. It is evident that comparatively little change (-0.19 to -0.24 $SD$) occurs for participants aged between 35 and 50 years in 2014, whereas younger and older participants exhibited a relatively steep decrease in D. For example, participants aged 18 years in 2014 showed an expected decrease in their level on D by 0.74 $SD$. Similarly, participants aged 65 in 2014 had an expected latent mean change (i.e., decrease) on D of 0.62 $SD$. In sum, these results indicate that the mean-level on D only shows a small decrease in middle adulthood, but more substantially decreases in early and late adulthood.
Supplemental Material – Figure SI. Predicted standardized latent mean change in D from 2014 to 2018 as a function of age in 2014.
Table S1

**Factor Correlations between Dark Traits in 2018**

<table>
<thead>
<tr>
<th>Factor (in 2018/at T2)</th>
<th>unresidualized (not controlling for D at T1) median correlation</th>
<th>residualized (controlling for D at T1) median correlation</th>
<th>% change</th>
<th>clpm</th>
<th>clpm % change</th>
</tr>
</thead>
<tbody>
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<td>Egoism</td>
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<td>.18</td>
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<td>Narcissism</td>
<td>.32</td>
<td>.14</td>
<td>.56</td>
<td>.26</td>
<td>.20</td>
</tr>
<tr>
<td>Psychological Entitlement</td>
<td>.52</td>
<td>.30</td>
<td>.42</td>
<td>.46</td>
<td>.12</td>
</tr>
<tr>
<td>Psychopathy</td>
<td>.72</td>
<td>.47</td>
<td>.35</td>
<td>.55</td>
<td>.23</td>
</tr>
<tr>
<td>Sadism</td>
<td>.47</td>
<td>.17</td>
<td>.64</td>
<td>.28</td>
<td>.40</td>
</tr>
<tr>
<td>Self-Interest</td>
<td>.35</td>
<td>.14</td>
<td>.61</td>
<td>.29</td>
<td>.18</td>
</tr>
<tr>
<td>Spitefulness</td>
<td>.65</td>
<td>.44</td>
<td>.33</td>
<td>.50</td>
<td>.23</td>
</tr>
<tr>
<td>overall</td>
<td>.52</td>
<td>.30</td>
<td>.42</td>
<td>.44</td>
<td>.15</td>
</tr>
</tbody>
</table>

*Note*. clpm = median residualized correlations between the dark traits in 2018 when controlling for the dark traits in 2014 (including all autoregressive and cross-lagged effects).
Supplemental Material – Table S2

**Latent Mean Difference as well as Predictors and Moderators of Latent Mean-level Change**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Latent Mean Difference&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Predictor&lt;sup&gt;2&lt;/sup&gt;: Latent Mean Difference of D</th>
<th>Moderator&lt;sup&gt;2&lt;/sup&gt;: Gender</th>
<th>Moderator&lt;sup&gt;2&lt;/sup&gt;: Age</th>
<th>Moderator&lt;sup&gt;2&lt;/sup&gt;: Age&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>-0.31*</td>
<td>β: 0.004, p: .938</td>
<td>β: 0.027, p: .689</td>
<td>β: -0.146, p: .015</td>
<td></td>
</tr>
<tr>
<td>Egoism</td>
<td>-0.24*</td>
<td>β: 0.52*, p: .118</td>
<td>β: -0.053, p: .322</td>
<td>β: -0.112, p: .051</td>
<td></td>
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<tr>
<td>Machiavellianism</td>
<td>-0.16*</td>
<td>β: 0.73*, p: .332</td>
<td>β: 0.120, p: .053</td>
<td>β: -0.185, p: .001</td>
<td></td>
</tr>
<tr>
<td>Moral Disengagement</td>
<td>-0.39*</td>
<td>β: 0.57*, p: .349</td>
<td>β: 0.051, p: .457</td>
<td>β: -0.032, p: .621</td>
<td></td>
</tr>
<tr>
<td>Narcissism</td>
<td>-0.20*</td>
<td>β: 0.25*, p: .036</td>
<td>β: 0.001, p: .988</td>
<td>β: 0.003, p: .959</td>
<td></td>
</tr>
<tr>
<td>Psychological Entitlement</td>
<td>-0.05</td>
<td>β: 0.54*, p: .207</td>
<td>β: -0.017, p: .769</td>
<td>β: -0.091, p: .110</td>
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<tr>
<td>Psychopathy</td>
<td>-0.27*</td>
<td>β: 0.76*, p: .522</td>
<td>β: 0.010, p: .879</td>
<td>β: -0.094, p: .140</td>
<td></td>
</tr>
<tr>
<td>Sadism</td>
<td>-0.09</td>
<td>β: 0.38*, p: .901</td>
<td>β: -0.056, p: .392</td>
<td>β: -0.070, p: .229</td>
<td></td>
</tr>
<tr>
<td>Self-Interest</td>
<td>-0.19*</td>
<td>β: 0.06, p: .754</td>
<td>β: -0.036, p: .509</td>
<td>β: 0.043, p: .384</td>
<td></td>
</tr>
<tr>
<td>Spitefulness</td>
<td>-0.34*</td>
<td>β: 0.64*, p: .931</td>
<td>β: -0.009, p: .888</td>
<td>β: -0.114, p: .044</td>
<td></td>
</tr>
</tbody>
</table>

*Note. 1 = Standardized latent mean difference with 2014 as reference. Estimates are based on the strict factorial invariance model with invariant factor variances across time. 2 = Standardized latent regression coefficients predicting latent change score from 2014 to 2018. Gender is coded as 0 = female and 1 = male, age is mean-centered.*

* p < .01
References


